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ABSTRACT

A study investigated whether there would be any significant difference in the academic achievement of primary grade students when learning science through the use of textbook instruction or literature-based instruction. Two third-grade classes in Paterson, New Jersey, were involved. The experimental group, (a class of 24 students), was instructed by a researcher, a library media teacher, using a literature-based (trade book) approach on a science unit about animals. The control group (of 23 students) was instructed by its classroom teacher using a science textbook for the same unit in science. A final unit test was administered to each group upon completion of the area of study. Results indicated no significant differences between the two instructional approaches in their relation to academic achievement. (Contains one table of data and 38 references. Appendixes contain raw scores for both classes.) (SR)

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ED 380 770

Science and Reading

By

Angela Lamartino

In partial fulfillment of

the requirements for the Master of Arts

Kean College of New Jersey

April, 1995

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ABSTRACT

This was a study of two groups of third grades with 25 students in each group who attended one urban area elementary school in the district of Paterson, New Jersey. An end of unit test was given to both groups to determine if there was any significant difference in academic achievement when studying a unit of primary science using resource-based instruction or textbook instruction. The hypothesis that there would be no significant difference between the samples was accepted.

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I would like to take this opportunity to thank Dr. Albert J. Mazurkiewicz (Chairperson of the Department of Communication Sciences at Kean College of New Jersey) for sharing his valuable and extensive knowledge of reading education and his guidance through the step-by - step process of putting this thesis together. His vast experience, intelligence, and patience helped to make this a highly educational and pleasurable finale to my studies at Kean.

DEDICATION

I dedicate this paper to my parents, Mr.and Mrs. Salvatore T. Lamartino for instilling in me a love of life and learning that has helped inspire me to pursue my educational aspirations.

According to Hillerich (1987), the problem with content area textbooks is that they often contain vocabulary too difficult for theirintended users. Jurd, Robinson, McConell, and Ross (1981) further state this is particularly prevalent in science textbooks.

Tyson and Woodward (1989) contend that content area textbooks try to teach too many topics, which results in little opportunity for in depth study of any particular subject. Furthermore, they state that most textbooks are dated, because districts can't afford to replace them frequently enough. This of course means that these texts lack current information.

Since the 1960's there has been a trend toward teaching science through a hands-on approach rather than through reading scientific materials according to Yore (1991). The reason behind this trend, as put forth by Elliot and Nagel (1987) is that science textbooks emphasize the products of science rather than its processes. As a result, it is believed that the science textbooks fail to teach the students to think scientifically.

Armbruster (1992) finds this de-emphasis on reading in science education distressing. First of all, she believes failure to read scientific materials will result in failure to meet goals of scientific literacy. Also, she cites the similarities in the processes of reading and science; namely that they are both interactive and constructive processes. Armbruster suggests that science trade books might be an alternative or supplement to science textbooks.

Hillerich (1987) maintains that nonfiction trade books can make individualizing content area reading instruction possible. That is that with the availability of so much nonfiction for children, teachers can get materials that meet their students' abilities more easily.

Pappas, Kiefer, and Levstik (1990) state that nonfiction trade books are much more able to do an in depth study of their topics. Exploring

topics through trade books allows students the opportunity to see how knowledge in particular areas are organized, utilized, and related.

According to Moss (1991), since nonfiction trade books are published every year, they are more current than the content area textooks which are not so readily replaced. Availability of nonfiction trade books through libraries and other sources make knowledge of the latest scientific information more accessible.

Sharp (1984) contends that nonfiction has long been used to teach science and cites Vicki Cobb's Bet You Can't: Science Impossibilities to Fool You as an example of classic science nonfiction. She recommends using picture books to reinforce basic scientific concepts. For example, she suggests using such books as It Looked Like Spilt Milk by Charles Shaw and Tomie de Paola's Cloud Book to help motivate students to learn weather concepts. Since these books are short and easy, Sharp proposes that they may be more palatable to the reluctant reader, nonreader, and poor reader.

Primary students require instruction in how to read for information in the content-area subjects. Since expository texts such as science textbooks are generally more difficult for

students to comprehend, it becomes a challenge for science instructors to find easy-to-read alternatives. These alternative resources should help build students' background knowledge while getting them started in the process of scientific inquiry. The question then arises: Does literature-based instruction provide a more effective way of achieving academic success in teaching science to primary grade children than textbook instruction?

Hypothesis

To provide information on the problem, the following study was established. The hypothesis of its study was that there would be no significant difference in the academic achievement of primary grade students when learning science through the use of textbook instruction or literature-based instruction.

Procedures and Sample

Two third grade classes in an elementary school in Paterson, New Jersey were selected to participate in the research.

The researcher, a library media teacher, instructed the experimental sample using a literature-based (trade book) approach on a science unit about animals. The control group was instructed by its classroom teacher using a science textbook for the same unit in science.

There were 24 students in the experimental sample and 23 students in the control sample. Both samples were comprised mainly of lower middle class black and Hispanic students. The students' ages were in the eight to nine - year - old range.

The control sample was instructed by its classroom teacher once a week for fifty minutes over a ten week period. In addition to its textbook readings and discussions, the control sample made paper plate animals and dioramas of the animals' habitats. The librarian assisted in the diorama project by supplying reference materials which the students used to research the animals' habitats.

The experimental sample met with the library media teacher once a week for fifty minutes over a ten week period.

The materials used for instruction included various trade books on animals, videotapes, childrens' encyclopedias and charts.

WEEK #1

The experimental sample watched the Reading Rainbow video entitled Chickens Aren't the Only Ones. This was followed by a brief discussion of the different types of animals mentioned in the video. The students were then asked to chose a particular animal to research. They were then divided into four study groups: chickens, spiders, bears, and tortoises.

WEEK #2

Each student researcher received his/her own copy of a trade book which was about the animal they had chosen to research . Each researcher was asked to read the book and to write a question that was answered in the book. The questions and answers were recorded on index cards and collected by the library media teacher.

WEEK #3

The experimental sample met with the librarian for a roundtable sharing of their questions and answers. These questions and answers were then put into the library computer to be included in a class book project.

WEEK #4

The experimental sample read a National Geographic book entitled Farm Animals while listening to an audiocassette of the book. Then the subjects were asked to write a question that was answered in the book. The questions and answers were recorded by the students and then collected by the librarian.

WEEKS # 5 &6

The librarian met with the experimental sample with additional information on farm animals taken from a childrens' encyclopedia. The librarian asked the students to find information about food and other products derived from specific farm animals.

They were also asked to find the male and female names for each farm animal. This information was added to the other material previously researched by the experimental sample and placed into the library computer. A class book was printed and individual copies were handed to each student.

WEEK #7

The library media teacher read the big book Giant Dinosaurs. This was followed by a discussion about extinct and endangered animals.

WEEK #8

The experimental sample listened while the librarian read a book about endangered animals. Occasionally during the reading she would stop and play the sound produced by an endangered animal from the CD-ROM Mammals (National Geographic). She then handed out trade books about.endangered animals to groupings of two and three students. They were asked to find interesting facts about their animal that they could turn into the question and answer format that they had been using all along.

WEEK #9

The librarian met with the experimental sample to ask each subject to produce an endangered animal booklet. These booklets began with three questions and answers about their endangered animal. Then they were asked to draw a picture of their animal in their natural habitat. Finally they were asked to list three things we need to do to save their animal.

WEEK #10

The library media teacher met with the sample and divided it into five separate study groups. Each group was given library books about their particular animal and were asked to find information about its life cycle. After a fifteen minute research session, the librarian pulled the experimental sample back together to discuss and complete a graphic organizer on animals covering all the major concepts covered over the ten week period.

A final unit test was administered to each sample upon the completion of the area of study for the research project. Test

results for the two samples were compared to determine if there were any statistically significant differences between the two instructional approaches in their relation to academic achievement.

Results of these tests were tabulated; means and standard deviations were computed; and the differences between the means were tested using by students' t.

Definitions

content area - categories of subjects taught in school which impart factual information students. (ie. science, social studies, math , English)

expository text - text written for the purpose of conveying factual information, explaining ideas, or presenting an argument

literature - nine forms of writing that include picture books, folktales, fables, myths, epics, modern fantasy, poetry, modern fiction, historical fiction, biography, and informational books

primary grades - levels kindergarten through third in the public schools of the United States

academic achievement - the point at which a student has learned new material, understands it, and assimilates old with new learning

Results

Table I shows that the difference between the means of the samples are not significant.

Table I

Means, Standard Deviations, and t Between the Samples

	M	S.D.	t
Resource	70.83	20.89	1.70
Text	59.78	23.62	

N.S.

While there are marked means difference (11.05) in favor of the resource-based instruction in the teaching of an elementary science unit on animals over textbook-based instruction of the same unit, and this t of 1.70 is approaching significance, the difference was in the end not statistically significant.

Conclusions and Implications

Although the results were not significant, the researcher found them to be meaningful, and useful for further study. Since the test given to both the experimental and control samples favored the control sample's method of instruction, and the means difference between the samples was so marked, it suggests that procedure is an effective one for further use as an instructional strategy.

Secondly, the researcher was pleased to see the students' enthusiasm for using the different types of resources including library books, videos, cassettes, and CD-Roms in the experimental group. These rather diverse materials offered a much broader

range of information than the text chapters did.

Finally, the researcher found the results to indicate a need to use both methods of instruction together. That is, to use an elementary science text program in conjunction with a resource-based instruction program. It may be, however, that the length of time for investigation of this resource-based program was a limitation and that if further time was spent a significant difference might occur. Further research should be diverted to this end.

SCIENCE AND READING:

RELATED LITERATURE

According to Weidler (1985) there have been very few articles about research and theory linking science and reading. She further states that those articles covered different areas of research related to science; concluding there is a lack of consistency in this literature.

Shymansky, Yore, & Good (1991) concur that there is a scarcity of articles in professional journals connecting science and reading, particularly in those geared toward elementary teachers. Contrary to Weidler's findings of lack of consistency in this literature, they have found a common thread. They report that this professional literature has moved from a trend of articles about a text driven model of reading to an interactive-constructive model of reading. The latter relies heavily on prior knowledge, guided imagery/mind mapping, exploring text structure, monitoring comprehension, and use of general reading strategies. Shymansky, Yore, & Good expressed uncertainty about whether this model is fully understood enough to be properly utilized by elementary science educators.

Armbruster (1993) voices concern over what she terms an ambivalent attitude towards reading by elementary science teachers. She states that on the one hand, they rate scientific literacy highly as evidenced by the survey taken of 522 K-8 teachers by Shymansky, Yore, & Good (1991). On the other hand, that same survey found that the majority of these teachers found reading to be an ineffective way to teach science. Despite this denigration of reading to learn science, most elementary science teachers prefer to use the textbook because of its structured program that removes the decision making responsibility.

Science textbooks have been the subject of numerous studies including those by Esralson (1978), William & Horne (1978), Shymansky & Yore (1979), and Orpwood & Souque (1984). In these studies, the elementary school science textbooks were found to be difficult to use. One reason cited was variation in readability within the text.

According to Elliot & Nagel (1987) in their study of nine elementary science series of the early 1980's, science textbooks emphasized the products of science rather than its processes. That is to say that little attention was given to teaching students the fundamentals of scientific inquiry.

Pizzini, Shepardson, and Abell (1989) in their study of middle school science textbooks found them lacking in fostering thinking skills. Specifically, they found low level cognitive questions were emphasized over higher order cognitive questions.

Tyson & Woodward (1989) found textbooks in general to be poorly constructed in that they attempted to cover too many topics in a general way. This superficial attention to many topics resulted in the students lacking real understanding of any of the topics. Added to this problem was that of dated textbook material. They attributed this problem to the fact that many districts can't afford to replace textbooks more frequently than every five to ten years.

A number of studies found textbooks in general to be written in such a way to render them "user unfriendly". Kantor, Anderson, & Armbruster (1983) found their organization and style to be confusing to students. Englert & Hiebert (1984) stated that most textbooks are written in a descriptive mode that makes retention of the material more difficult. Fielding, Wilson, & Anderson (1984) maintained that content area textbooks infrequently used widely accepted organizational patterns such as cause and effect, temporal sequence, or compare and contrast.

Since reading instruction in the primary grades is mainly based on narrative text and that the content-area text such as the science text is reported to be so "user unfriendly" is it any wonder that reading researchers and experts are looking for easy-to-read alternatives in the world of science trade books. Let's take a look at this relatively new field of inquiry.

One advantage to using literature for teaching science is that it makes it easier for the teacher to have an individualized content area reading program. With the accessibility of numerous

children's nonfiction books in print a teacher can more readily find material that meets the students' individual reading levels according to Hillerich (1987) and Shanahan (1989).

Pappas, Kiefer, & Levstik (1990) provide another advantage in using nonfiction trade books. They claim this literature is able to give in-depth analysis of content area topics unlike that of textbooks. Also if students are able to read more than one book on a content area topic, they can learn the concepts and terms associated with it.

Fielding, Wilson, & Anderson (1984) state that nonfiction trade books were written in a more logical style and arrangement. This coherently organized material makes for a more "user friendly text."

Since trade books are published yearly, they have more up-to date information according to Moss (1991). Since these books are so readily accessible through libraries and other sources, students are better able to keep abreast of the latest developments in the field.

Numerous sources including Greenlaw (1983), Purves & Monson (1984), and Huck, Hepler, & Hickman (1987) note how visually pleasing nonfiction trade books tend to be. Children are drawn to these books by their interesting covers, pleasing graphics, and effective illustrations.

Smith (1993) states followers of literature-based reading instruction generally give two reasons for including trade books in reading instruction: improvement in students' reading ability and in their attitudes toward reading. He further states that a third less discussed reason for using literature in reading instruction is the possible improvement in the students' grasp of content area concepts.

Smith used literature to improve social studies content learning in his study, but his instructional procedures are easily adaptable to the teaching of science. The four step plan included determining what concepts to teach, preteaching background information, reading/discussing the text, and providing follow-up enrichment activities.

Olson & Gee (1991) asked 47 primary grade teachers in Texas, Florida, and North Carolina about teaching methods they have found effective in helping their students understand and retain information from science trade books. Some of the most popular suggestions included: developing concepts and vocabulary, utilizing manipulatives to reinforce concepts being read, retelling and summarizing, and developing visual imagery.

Dole & Johnson (1981) recommend a collaborative effort between the science teacher, the reading teacher, and the librarian in using science trade books. Among their recommendations are: tell the others (librarian and reading teacher) what topic they are covering in class, ask them for related materials, let them know the range of reading abilities in the class, and to actually sit down and read the books themselves.

There are numerous sources for selecting science trade books. They include Beverly Kobrin's Eyeopeners (1988). It

provides annotations and makes suggestions for classroom use for many of its titles. The science education journal Science and Children provides an annotated bibliography of "outstanding science trade books" in its March issue. The National Science Associaton in conjunction with the Children's Book Council compiles their own annotated bibliography of outstanding books in the field each year according to Moss (1991).

Lytlle (1982) performed a study examining the effects of using science trade books on students' achievement and attitude for her master's thesis. The subjects of Lyttle's study were 47 fourth grade children. The study was conducted over a six week period which the control group used the textbook chapters on animal and plant life, while the experimental group used trade books on those topics. Lyttle's findings indicated that there was no difference in achievement or attitude between members of the experimental and control samples. Regrettably, Lyttle did not

describe her instructional procedures as Smith did in his study. I would have liked to have known exactly what she did with each sample.

Summary

Science and reading need to be brought together in ways that will bring more meaning to the elementary student. The science textbook has been maligned in the professional literature as being poorly constructed, outdated, and contrary to the scientific processes.

Trade books can be used to complement hands-on exploration of scientific concepts. They are generally easier to use, more appealing to the eye, and have more in-depth and up-to-date coverage of the concepts.

Primary children require instruction in how to read for information in the content area subjects. Since textbooks have not

exactly proven to be helpful in this area, it becomes a challenge for elementary science educators, reading teachers, and library media specialists to research further into the possibilities of using science trade books as a component of the elementary science program.

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APPENDICES

APPENDIX A

EXPERIMENTAL SAMPLE	
STUDENT	SCORE
#1	100
#2	100
#3	100
#4	100
#5	95
#6	85
#7	85
#8	80
#9	80
#10	75
#11	75
#12	70
#13	70
#14	65
#15	65
#16	65
#17	65
#18	65
#19	50
#20	50
#21	45
#22	45
#23	35
#24	25

APPENDIX B

CONTROL SAMPLE	
STUDENT	SCORE
#1	100
#2	85
#3	85
#4	85
#5	85
#6	85
#7	80
#8	80
#9	70
#10	65
#11	65
#12	60
#13	60
#14	50
#15	45
#16	45
#17	45
#18	45
#19	45
#20	30
#21	25
#22	25
#23	15